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# DOWNSTREAM EMISSIONS TRADING FOR TRANSPORT

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**ABSTRACT:** This chapter addresses the issue of downstream emission trading within the transport sector. It is argued that emission trading may be relevant in this sector and that hybrid instruments combining tradable permits with taxation may be particularly efficient. Moreover, there is no sound reason to dismiss downstream trading in principle on the basis of their potentially high transaction costs, because of the large number of mobile sources to deal with. Downstream schemes are presented, which are feasible both on technical and institutional grounds. Regarding the need to coordinate transport emissions reduction at the international level, and especially regarding international transport, it is argued that emission trading in transport could be quickly implemented contrary to harmonisation of fuel taxation. It is concluded that the urgency now is to design and test fine-tuned practical schemes in order to actually implement policy aiming at deep reduction of fossil fuel consumption.

**KEYWORDS:** transport, emission trading, downstream, Europe, international coordination

## 1. INTRODUCTION

Transport generated approximately 25 per cent of emissions of CO<sub>2</sub> in the world in 2003, and this share amounted to 30 per cent in OECD countries. Among these emissions of one of the main greenhouse gases (GHG), 18 per cent come from road transport; 3 per cent from air and 2 per cent from maritime transport (OECD 2007). Moreover, emissions from transport have increased by 31 per cent in the world between 1990 and 2003. Given recent evidence on the need for deep GHG reduction in the next few decades (Stern, 2006), several industrialised countries have set ambitious targets, e.g. a reduction by four of their emissions by 2050. Regarding transport, the policies will

have to be more determined: they should aim at reducing total consumption which means reducing vehicle kilometres travelled, not just vehicle specific consumption.

Among the measures identified to reduce transport intensity, carbon taxes and vehicle taxes seem to be the most cost-effective (OECD 2007; Parry et al. 2007). However, the “fuel tax protests” of September 2000 in several European countries have shown that public opinion is very resistant to fuel tax increases (Lyons and Chatterjee 2002). This resistance can also be explained by concerns about fairness, since many households depend on the car for day-to-day living and for getting to work. Moreover, fuel tax

increases would require the international harmonisation of fuel taxation in different countries, which, in Europe, appears to be extremely difficult.

In the light of these difficulties, another instrument which combines economic incentives and quantity control, namely marketable or Tradable Permits (TPs), might be of interest. This category of instruments is part of a wider one, namely transferable permits. According to a general definition given by Olivier Godard (OECD 2001), transferable permits cover a variety of instruments that range from the introduction of flexibility into traditional regulation to the organisation of competitive markets for permits. These instruments have in common: the setting of quantified physical constraints in the form of obligations, permits, credits or rights allocated to target groups of agents consuming scarce resources; and the permission granted to agents to transfer these quotas between activities, products or places (offsetting), periods of time (banking) or to other agents (trading, hence “tradable permits”).

We will show that there are several directions of theoretical relevance for the use of emission trading in transportation, especially “cap-and-trade” schemes, and that hybrid instruments combining tradable permits with taxation may be particularly efficient. Moreover, we will also show that there is no sound reason to dismiss in principle downstream trading on the basis of their potentially high transaction costs, because of the large number of mobile

sources to deal with. Downstream schemes will be presented, which are feasible both on technical and institutional grounds, thanks to available electronic technology. Regarding the need to coordinate transport emissions reduction at the international level, and especially regarding international transport, we will also argue that emission trading in transport could be quickly implemented contrary to the harmonisation of fuel taxation.

This chapter is structured as follows. First, starting from the theory about tradable permits, their relevance in transport emissions is analysed. Second, the case for downstream approach is discussed and two proposals of tradable rights for fuel consumption for private vehicles and for freight transportation are presented. Third, international aspects regarding border effects and international coordination in the European Union and with other regions in the world are analysed. In the next two sections, some evidence regarding behavioural effectiveness and acceptability issues are presented.

## **2. THE THEORETICAL CASE FOR ECONOMIC EFFICIENCY**

The economic theory of pollution permit markets is well established now. It started from the seminal work of Coase (1960) on external costs, showing that with low transaction costs and well-defined property rights an efficient distribution of resources (including externalities) could be achieved. This was followed by the work of Dales

(1968) on regulating water use, and the formalisation of pollution permit markets by Montgomery (1972).

In a “cap-and-trade” scheme the regulating authority determines the total amount of pollution acceptable (i.e. the “cap”), distributes the permits (or quotas or rights<sup>1</sup>) among the agents, who are liable to return these permits to the authority in proportion of their emissions. The agents are authorised to trade the unused permits.

The theory may be summed up as follows (Baumol and Oates, 1988). A system of tradable permits (TPs) equalises the marginal costs of reduction between all emission sources. Under some assumptions this is a sufficient condition for minimising the total cost of achieving a given emissions reduction objective. This result is obtained independently of the initial allocation of rights: it should be stressed that this makes it possible to separate the issues of efficiency and equity. Moreover, opposite to conventional taxation, the public authority needs no information about damage and abatement cost functions in order to fix the optimal level of intervention: with permit markets the authority needs only to fix the total amount of pollution.

Indeed, regarding the quantitative objective of emissions reduction, the essential difference between taxes and permits lies in the fact that in practice the public authorities

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<sup>1</sup> The terms “quota”, “permit” or “right” will be used interchangeably thereafter.

do not possess full information on the reduction costs for the different agents. With a permit-based approach, achieving the quantitative objective of emissions reduction is guaranteed, but there is no guarantee with regard to the actual level of the marginal costs of reduction. On the contrary, in the case of the tax, the marginal cost of reduction for each agent is fixed, but there is no guarantee with regard to the amount of emissions reduction.

This uncertainty makes it difficult for the regulator to make a choice as errors regarding reduction costs for agents may be very costly to the community, particularly regarding the distribution of efforts over time and between agents. Nevertheless, a number of criteria may be relevant when making this choice (Baumol and Oates, 1988).

A first criterion for the appropriateness of a quantity-based approach (i.e. quotas) is whether the damage to the environment is increasing very rapidly or becoming irreversible when certain emission thresholds are reached or exceeded. In this case, TPs provide a relative advantage over a tax approach since quotas control reduces the cost of errors (Weitzman, 1974).

However, there is a controversy regarding the pace of damage cost function of greenhouse gas emissions, between those who argue it is rather steep relative to the abatement cost function (e.g. Stern, 2006), and those who argue the opposite (see for instance Nordhaus, 2006). In order to

overcome this uncertainty about the costs of (in)action, a hybrid approach combining permits and a “safety valve” for price would provide a pragmatic solution (Roberts and Spence, 1976; Baumol and Oates, 1988, pages 74-76). It involves setting a payment in full discharge (i.e. a “safety valve”): this way, the emitter could be discharged of his/her obligation to return permits by paying the payment in full discharge for each unit of emission exceeding the rights he/she holds. This payment in full discharge would then set the upper bound of the permit price. This hybrid solution is to be applied when the regulator must make decisions either with regard to the temporal distribution of efforts (for example annual objectives) or with regard to the distribution of this effort between the different actors or sectors.

A second criterion is whether agents are more sensitive to quantitative than to price signals, particularly if the price-elasticity of demand is low in the short or medium term as is the case in transportation. Here again a permit system is more appropriate.

For example, emissions from travel may be reduced by various means: by changing driving style; by reducing vehicle-kilometres travelled (by increasing the number of passengers in vehicles, reorganising trips or changing the locations of activities); by changing one’s vehicle or changing transport mode in favour of one which consumes less energy. Some of these actions may be implemented in the short term, while others such as changing one’s vehicle,

changing one’s place of work or residence, may take much longer. Thus price-elasticities of fuel consumption are generally low in the short term and considerably higher in the long term. For example, for fuel consumption, the price-elasticity values are between  $-0.2$  or  $-0.3$  in the short term<sup>2</sup> and  $-0.6$  or  $-0.8$  in the long term (Goodwin, 1988; Graham and Glaister, 2000; Brons et al, 2006).

Furthermore, a third criterion that is an important factor for the effectiveness of TPs is the heterogeneity of the agents involved in the system. This means that the marginal costs of abatement must be sufficiently different between agents in order to allow benefits from trading permits, thereby making the market function effectively.

For instance, if one considers the use of private car, the marginal abatement cost curves are highly varied and, in particular, rise as one moves from urban to suburban and then to rural settings. Changes in the locations of activities in order to reduce the distances between different activities are much easier to make in urban areas than in suburban or rural locations, as a result of the density of available activities. Reducing commuting distances is easier in a conurbation which provides a high density of job and housing opportunities. Likewise, public transport which provides an alternative to the private car is more frequently available in urban areas.

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<sup>2</sup> i.e. a 10 per cent increase in price would lead to a 3 per cent reduction in fuel demand.

To sum up, there are several directions of relevance for TPs in the transport sector. Moreover, the controversy about efficiency opposing pure taxation to pure tradable permits looks now old-fashioned: the design of practical schemes should be based upon hybrid solution combining TPs with the “safety valve” referred to above.

There are now a lot of experiences in implementation with TPs, for instance in the fisheries, and in the fields of construction rights and water pollution, some with success other with failures. The US “Acid Rain” scheme is a good example of a large-scale system of tradable sulphur dioxide emission permits between power plants (Godard, 2000). These experiences make it possible to identify some general criteria of success (OECD, 1997, 1998) which include among others: the simplicity and the clearness of the system; the possibility of effective market operation; the credibility of emissions monitoring and sanctions; and the long term validity of permits.

### **3. TOWARDS PRACTICAL IMPLEMENTATION: THE CASE FOR DOWNSTREAM APPROACH**

The main arguments against the use of permits in the transport system are the cost of administering and monitoring permits over a large number of mobile sources, i.e. the transaction costs. This is why trading is generally considered only at the upstream level, i.e. fuel producers and refiners: however some limits of upstream trading

can be identified. Since transport in Europe is already partly concerned by the current Emission Trading Scheme, schemes regulating emissions of ground transportation needs to be modulated in addition to this one. Two proposals are recalled, one regarding a domestic tradable fuel rights scheme for private vehicles, the other regarding a tradable fuel rights scheme for freight transportation. Final sections address the phasing in of these schemes and the issue of administrative costs.

#### **1. The crucial issue of transaction costs**

Stavins (1995) has shown that when transaction costs are involved the initial allocation of rights affects the final balance and the total cost of reducing emissions. Thus reducing these transaction costs is a crucial issue: this should be done by avoiding finicky regulations or by facilitating the activity of intermediaries – like brokers – between vendors and purchasers (Hahn and Hester, 1989; Foster and Hahn, 1995).

Crals and Vereeck (2005) offer a definition and an in-depth comparison of transaction costs between taxes and tradable permits. Transaction costs include legislative, information, search, set-up, operational, negotiation, contract, monitoring and enforcement, and compliance costs. Their conclusion is that the overall costs depend on the details of the scheme design, whether tax-based or permits-based.

For instance permits distributed for free on a large scale incur almost no information costs when compared with taxation. An upstream system with a few participants may incur high costs of negotiation (or lobbying) when compared with a large scale downstream system with a fixed allocation. Combined with modern technology and brokerage without regulatory interference for trading, permits operational costs can be set at their minimum.

Last but not least, with corrective (e.g. personalised) taxation there is a trade-off between transaction costs and environmental effectiveness. This has to do with the issue of acceptability (see below). On the opposite the permits allocation scheme needs no trade-off with its environmental effectiveness since permits are by design used in their most efficient way.

## **2. Some limits of upstream trading**

This issue of administrative costs is the main argument against the use of permit systems within the transport sector which, by definition, involves a large number of mobile sources. This explains why propositions in the literature have been initially confined to targeting vehicle unit emissions through auto makers (Albrecht, 2000; Wang, 1994; and the California's ZEV programme in Raux, 2004). The main advantage of these proposals is that the permit systems would involve a small number of participants thus allowing lower transaction costs. Permits on household car ownership are another indirect way of

controlling car travel (Walton, 1997) but the linkage with actual fuel consumption is very crude. These systems have the disadvantage of ignoring the other component of total emissions, fuel consumption through actual vehicle use by drivers.

Transport supply might be another area of TPs implementation. For instance, local governments, which plan land use and define transport policy and hence provide transport infrastructure and services, could be involved in emission trading schemes (following the idea of "city carbon budget" by Salon and Sperling, 2008). However, the basic difficulty is to monitor mobile sources which can be fuelled somewhere in a specific administrative area and can travel through other administrative areas: to which local governments should the liability of emissions be attributed?

Regarding fuel consumption by transport vehicle users, in order to reduce the administrative costs, it seems relevant to set up the system of permits at the very upstream, at a level where the actors are very few: it could be the fuel refiners or distributors, which already transmit the current excise duty to the ultimate consumer and return the product of the excises to the government. By imposing to the producers and the importers of oil, natural gas and coal to return the quotas, the system would cover the whole CO<sub>2</sub> emissions resulting from the combustion of the hydrocarbon fuels by the end-users (Winkelman et al, 2000).

In a study on the design of a GHG emissions trading system for the United States, Nordhaus and Danish (2003) argue the case for a hybrid approach which would combine an upstream procedure for fuel producers with a downstream procedure for automobile manufacturers. However, as German (2006) points out, there are a number of difficulties with such a scheme: one of the main problems is the risk of double counting both in terms of credits to automobile manufacturers for fuel efficiency improvements and in terms of allowances for fuel producers: credits for vehicle manufacturers are based on the entire lifetime of the vehicle, while allowances for fuel producers are for emissions in the current year. Furthermore, this type of programme does not cover the existing vehicle fleet, which is known to have a lifespan of around 15-20 years on average. In short, such a programme would be highly complex.

Moreover an upstream system is prone to two disadvantages. Firstly, there is a risk of diluting the incentive effect of permits on the final emitter, so that they implement the complete panoply of behavioural adaptations which are available to them. Indeed, whether the permits are acquired by auction or distributed free to the fuel suppliers, these suppliers would pass opportunity costs<sup>3</sup>

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<sup>3</sup> As the permits will have a value on the market, the opportunity cost for a fuel supplier would consist in not selling on the market the permits which they received for free, or not recovering their value in the form of extra costs to their consumers.

relating to these permits to their customers as a simple additional fee. In this case, the advantage vis-à-vis the current system of fuel taxation is null.

The second disadvantage appears in the event of free allocation of quotas to the fuel suppliers. The fuel suppliers could transmit the opportunity costs relating to these permits: this would not call into question the economic efficiency of the system but certainly its acceptability, since those supporting the effort of reduction would not benefit from the revenue created by the free allocation. An upstream permits system thus seems, for reasons of political acceptability, incompatible with a free allocation<sup>4</sup>.

### **3. Transport in Europe is already concerned by an emission trading scheme**

The advantage of complete coverage by an upstream permit system has lost its strength today in the European Union, with the operation of the CO<sub>2</sub> Emission Trading Scheme (ETS) since 2005 (see Box 1). Since electricity production is already included in the ETS, ground transportation in Europe is impacted through rail operation and the future potential large scale use of electric plug-in vehicles.

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<sup>4</sup> Unless this revenue is taxed, from which arises a new complexity.

### **Box 1: The European Emission Trading Scheme**

The Emission Trading Scheme (ETS) is in force since 2005 and has been set in order to help the European Union to reach the Kyoto Protocol targets of its Member States. It covers currently more than 12,000 energy intensive fixed industrial facilities and power plants and till now concerns only CO<sub>2</sub> emissions. After the first phases of the scheme which have seen an over-allocation of free allowances by Member States to their industries and a subsequent collapse of carbon price, the scheme will be modified by 2013.

Following the EU commitment to reduce its emissions by 20% compared to 1990 levels, total EU industrial emissions will be capped at 21% below 2005 levels by 2020. New industrial sectors will be included along with two new greenhouse gases (nitrous oxide and perfluorocarbons). It is expected that 50% of all EU emissions will be covered. In order to avoid over-allocation by member states to their domestic industries, national allocation plans of the ETS first phases will be replaced by an EU-designed allocation method based on benchmarking vis-à-vis the most efficient techniques and processes.

Moreover, from 2013 auctioning of emission allowances will be introduced and increased with the aim to have 100% auctioning in 2027. Sectors not included and which use fossil fuel, such as ground transport or buildings for instance, are expected to achieve a 10% reduction of emissions by 2020: national caps have been established for these sectors.

Regarding the articulation with world international freight transport, the inclusion of air transport in the European ETS is already on tracks by 2012 (see Box 2).

When it comes to maritime transport, the same approach might be adopted by the European Commission as stated in the “climate package” adopted in December 2008. If no agreement is reached with the International Maritime Organisation by 2011, the Commission should make a proposal to include international maritime emissions with the aim of its entry into force by 2013. These initiatives are first steps towards the inclusion of international

transport in a worldwide emission trading scheme.

Since aviation is already included in the ETS – and maritime transportation will potentially in the near future – a scheme regulating emissions from ground transportation should now be modulated as a complement to the ETS.

Indeed end-users are an important target for emissions reduction since vehicle use represents about 75 to 80% (tank to wheel) of whole emissions from the point of view of vehicle life-cycle analysis (from cradle to grave). End-users as the final decision-

makers can modify, albeit with more or less constraints, their travel choices, activity locations, or choice of vehicle or transport mode. Moreover, according to Baumol and Oates (1988), the incentive to reduce CO<sub>2</sub> emissions should be put as close as possible

to the pollution source, in order to maximise the policy efficiency. This pleads for targeting the fossil fuel consumption of end users.

**Box 2: The inclusion of aviation in the European Emission Trading Scheme by 2012**

Given the slow progress of negotiations regarding international air transport emissions at the International Civil Aviation Organisation (ICAO), the European Commission decided in 2005 to take unilateral action and proposed to bring aircraft operators into the EU ETS for all flights arriving or departing from the European Union. According to the directive 2008/101/EC issued in November 2008, the scheme will include all the flights, starting in 2012. The scheme will initially concern only CO<sub>2</sub> emissions and not nitrogen oxides and water vapour with its condensation trails.

The total quantity of allowances will be calculated on the basis of average CO<sub>2</sub> emissions for the aviation sector over the period 2004-2006: it will amount at 97% of this quantity in 2012 and set to decrease gradually after the starting of the scheme. A fixed percentage of this total will be allocated free of cost (85 per cent in 2012) and the remainder will be auctioned.

Each aircraft operator will then apply for a free allowance based on its historical activity (tonne-kilometres) and a benchmark ratio of total quantity allowances to the tonnes-kilometres achieved by the operators. In addition, operators will be able to buy allowances from other sectors covered by the ETS.

In the next two sections schemes of fully downstream permit markets within the transportation sector are proposed. This is undertaken separately for private vehicles and for the freight industry, due to significant differences in economic behaviour between these two sectors.

**4. Proposal for a domestic tradable fuel rights scheme for private vehicles**

Here is summarised a proposal of “tradable fuel consumption rights” for motorists (for a detailed description and discussion see Raux and Marlot, 2005; Raux, 2010). This idea has some connections with the more general one of “domestic tradable quotas”<sup>1</sup> which would encompass all fossil fuel

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<sup>1</sup> This idea was firstly developed by David Fleming (<http://www.dtqs.org/> Accessed in December 2008).

consumption of households, thus including e.g. home heating.

According to this scheme, motorists as consumers of fuel and hence emitters of CO<sub>2</sub> would be liable for the obligation to return the corresponding fuel rights to the regulating authority. The right corresponds to an authorisation to emit the CO<sub>2</sub> equivalent of a litre of fuel<sup>2</sup>. These rights may be held initially by the agent or purchased in the permit market.

Different options are available for allocation of fuel rights and these refer to different views of equity. One option would be to allocate free fuel rights on a per capita basis. The rate by which rights allocations would be reduced each year would be announced several decades ahead and periodically adjusted by a regulatory authority independent of the government in office.

In order to consume more fuel than his/her free allocation, a consumer would have to purchase additional rights on the market. On the other hand, a consumer who does not use all his/her allocated rights could sell them.

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<sup>2</sup> Currently in France, 2.4 kg CO<sub>2</sub> for a litre of gasoline and 2.6 kg CO<sub>2</sub> for a litre of diesel. Strictly speaking, this value should vary according to the type of fuel: diesel fuel contains more carbon than gasoline, gasoline with ETBE can have different emissions than gasoline without ETBE. A conversion factor would apply for each kind of fuel. For the purpose of simplicity of exposition we have assumed that one right unit corresponds to one litre of any fuel.

Practically, participants would buy and sell rights through intermediaries like their usual bank operator or buy them at the petrol pump.

In order to reduce administrative costs and enforce a reliable monitoring, fuel rights debit would be validated when the motorist buys fuel at the pump. The rights, awarded annually, would be held on a chipcard. This could be either a smart card compatible with the automatic teller machines (ATM) that are already installed at petrol stations or a modification of credit smartcards currently used in these ATM. It would also be possible to purchase or resell permits in banks, using ATM bank distributors or over the Internet.

Other options in design include the choice of limited or unlimited validity of permits, and a face CO<sub>2</sub>-equivalent value decreasing year-to-year in order to limit speculation.

For acceptability reasons the management of fuel rights would not be left entirely to the market: rights would be sold and bought back at a price fixed by the authority. This implies that the authority would adjust this price on a yearly basis.

It would be socially unacceptable to apply suddenly the fuel rights system to all motorists. So the implementation of the fuel rights market should be progressive and would coexist with a CO<sub>2</sub> taxation system. Moreover, taking part in the fuel rights system should be voluntary.

A solution is to set up the “safety valve” referred to above, which would be paid both by fuel consumers who wish to stay outside the rights market, and those who are taking part in it but have used up their allocation and are either unable or unwilling to purchase permits. That would play the role of a conventional “CO<sub>2</sub> tax” and constitute a price ceiling of permits on the market. It would have to be adjusted with reference to the country’s international commitments to reduce emissions.

To sum up, the current fuel excise taxation system will be supplemented by the coexistence of two schemes: the rights market on a voluntary basis on the one hand, the extension of fuel taxation with a “CO<sub>2</sub> tax” for those not wishing to take part in the rights market on the other hand. These two systems will be the alternative proposed to motorists: the incentive to adopt the fuel rights system will be effective if the price of fuel right stays lower than the CO<sub>2</sub> tax.

### **5. Proposal for a tradable fuel rights scheme for freight transportation in Europe**

Fuel rights for freight transportation would also be based on quotas of CO<sub>2</sub> calculated from the carbon contained in the fuel (mainly diesel oil for trucks) consumed by any freight vehicle user, i.e. a for-hire carrier or a shipper performing its own transport (Raux, 2010). Obligation would be made to the user to return to the regulating authority the corresponding rights, which would then be cancelled.

In principle there should be no free allocation to shippers. In case of full integration in the ETS shippers holding ETS quotas could use them for transport. A free allocation could be devised for transport operators in order to improve the acceptability of the scheme. Given the European scale of freight ground transportation, the principle of a free allocation or not and, if a free allocation is adopted, the choice of the method of allocation and the calculation of the allocations would be decided at the level of the European Union.

The for-hire carrier (or the transport organiser) would negotiate with the shipper in order to get (or be paid for) fuel rights in view of the achievement of transport operation. Carriers holding unused rights (after having transferred the required quantity to the regulating authority) could sell them.

All freight transport modes would be covered, i.e. road, rail, river, maritime and air modes. This is already the case for aviation by 2012 (see above). The geographical coverage would be at the level of the European Union at least.

Transfer of quotas to the regulating authority would be monitored at the time of fuel purchase, either at the pump or when filling a tank on the carrier’s site.

The entrance into the fuel rights trading system would be on a voluntary basis. A

“CO<sub>2</sub> tax” would apply to the fuel consumers not wishing to take part in the fuel rights market. Participants to the rights market who have exhausted their initial allocation could buy additional rights on the market or pay the CO<sub>2</sub> tax as a “full discharge” payment. Other transport sectors or agents not included in the fuel rights market (eventually the private cars, depending on the extension of fuel rights market to them, see above) would be covered at least by a CO<sub>2</sub> tax.

## **6. Phasing in**

Fuel rights markets in the transport sector could be phased in. The fact that a new market is implemented does not mean that it will gain the support of all of the stakeholders overnight. Operations on rights transfer – for instance, debiting procedures at the pump – will require technical and institutional modifications which inevitably take time. This said, the necessary modifications might well happen quickly as fuel distributors will wish to attract customers who want to participate in the rights market.

If stakeholders are free to enter the market, the incentive for them to do so will implicitly be the existence of the “CO<sub>2</sub> tax”, provided that the latter, driven by governments, remains higher than the price of fuel rights on the market. The other role of the “CO<sub>2</sub> tax” is to ensure fair treatment by avoiding ways out of emission reduction requirements.

For political and practical reasons, the different fuel rights markets could be introduced separately, i.e. on different dates for the freight transport and private car sectors. Of course, for a complete coverage, public transport operators should be included in the scheme for passenger transportation, along with private car owners.

The crucial point is that as soon as at least one of the markets is implemented a general “CO<sub>2</sub> tax” is established for all of the agents not yet concerned. To ensure the acceptability of these measures, the tax should be reasonably low to begin with, with increases to be phased in over several years announced in advance. This means that the different markets will have to be established within a limited timeframe.

## **7. How administrative costs are reduced?**

ETS operation has revealed that the costs of administering and reporting emissions is high for small emitters, i.e. structures managing only a few stationary installations affected (for example, a boiler in a hospital). This is a good example of how a scheme design influences its operation costs. On the opposite the above proposals on fuel rights are aimed at avoiding these pitfalls.

In the case of fuel rights for drivers, the principle of a fixed free allocation is proposed. It avoids the need for complicated calculations that are costly to administer on an individualised basis. The simplicity of the allocation principle proposed and the

transparency of the calculation as well as the fact that it applies to the entire population, reduces any risk of government decision-making being captured by private interest groups.

For freight transport, it is proposed that there be no free allocation to shippers, which eliminates any reason to lobby for allocations and the adverse consequences that might occur. This is in line with the developments agreed regarding the ETS, which will introduce progressive auctioning of permits by 2013. However, regarding road freight vehicles, in view of increasing the scheme acceptability fuel rights could be allocated as a fixed allowance free of charge per vehicle. In order to reduce the risks of escalating allocations if Member States pursue a “free rider” policy, the flat-rate allocation method should be defined at the European Union level.

As a general rule, the principle of fixed, cost-free allocations, which avoid complicated calculations, sharply reduces the administrative costs of these schemes. There would still be the costs of monitoring emissions and managing fuel rights transactions, which the proposals above have sought to keep as low as possible.

## **4. BORDER EFFECTS AND INTERNATIONAL COORDINATION**

### **1. Border effects and the issue of “tank tourism”**

Overall the above scheme of fuel rights for private vehicles is designed in a way that allows a domestic implementation, that is to say a State regulating private cars fuel consumption in order to comply with its own commitments regarding CO<sub>2</sub> emissions<sup>3</sup>. In this scheme foreign drivers would not benefit from the fuel rights free allocation of the country they visit and would have to buy rights or more probably pay the “CO<sub>2</sub> tax” on automotive fuel.

However, a domestic implementation raises the issue of coordination with neighbouring countries, because of the potential of cross border fuelling (i.e. “tank tourism” by a driver residing in one country and travelling to another one in order to fuel the vehicle): the driver behaviour results from a trade-off of the price difference between the two countries and the distance travelled (Rietveld et al 2001; Banfi et al 2005). In case of no coordination between neighbouring countries, an obvious limit would be put on a government trying to control more strongly fuel consumption. Yet it should be underlined that this problem is

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<sup>3</sup> In order to attribute national responsibilities UNFCCC greenhouse gases inventories per country are based upon fuel sales within the country, excluding fuels used in ships or aircrafts for international transport.

not specific to quotas approach but also concerns the tax approach.

When it comes to the scheme of fuel rights for freight transportation, which is designed at the scale of the European Union, a legitimate interrogation remains, that of the possible competition of carriers external to the European Union. In fact, the carriage of goods is less prone to economic distortions than the other branches of industry: freight will always have to be loaded in locations within the EU in order to be distributed for use in other locations within the EU, whether processing industries or final goods delivery locations. The only notable incidence would come from carriers being able to load fuel outside the European Union, thus potentially not subjected to any CO<sub>2</sub> taxation or fuel rights scheme, and then carry out a transport within the EU. This competition could be significant in the border countries, since trucks can have a cruising range of 1,500 to 3,000 kilometres on a single tank (CEC, 2002). This issue would require some kind of coordination with neighbouring countries.

## **2. International coordination within the European Union and with other regions**

Within the European Union national caps have been established regarding sectors not included in the ETS like ground transportation. While in principle the economic incentive of the ETS guarantees the future reach of the target for the sectors covered there is no such guarantee regarding transport: there is no economic sanction

preventing potential “free rider” behaviour by any Member State. That is why the issue of carbon taxation in Europe is set again in discussion.

This is a critical issue especially in the European Union where the proposals for an EU-wide tax based on both carbon and energy date back to the 1990s. Currently the Energy Taxation Directive imposes only minimum rates of tax on energy products in order to reduce distortions of competition between Member States.

Indeed, taxation is an area in the EU legislation where unanimity is required from Member States (which are 27 today). While some countries support the idea of a carbon tax (some of them like Sweden or Finland have already implemented such a tax), others are fiercely opposed to any greater cooperation on energy taxation issue, which they see an interference in their own domestic taxation policy.

On the contrary, in the EU legislation procedures, emissions trading comes under environmental matter and there is no need for unanimity but rather for “qualified majority” voting, that is to say a majority of countries suffices to impose such a legislation.

Recently in June 2010 a new proposal for a European carbon tax was dismissed again by the European Commission. These 20 years of political discussion about carbon taxation in Europe without any step forward are to be opposed to the speed of ETS

implementation: the Green Paper on GHG emissions trading within the European Union was issued in 2000 and the Directive on ETS in 2003 with an entry in force in 2005.

From a European – and a political economy – point of view, emission trading scheme looks like an obvious and particularly attractive scheme around which to organise the regulation of transport emissions, especially when considering the international nature of this activity. This should be the frame upon which to coordinate transport emissions policy with other regions in the world, of which some are currently discussing their own emission trading schemes.

## **5. BEHAVIOURAL EFFECTIVENESS**

Due to the novelty of the instrument, empirical knowledge regarding this topic is limited.

According to their design TPs should have an obvious effect on emissions: fuel consumers should at least comply with their allowances or buy supplementary emission permits (for instance if they want to maintain their current behaviour). Moreover, there is another effect in case of free allocation, due to the possibility to sell unused permits: this is an incentive to make further abatement efforts. This last effect is

expected to yield supplementary positive outcomes when compared with taxation<sup>4</sup>.

Moreover, due to the specific nature of tradable permits applied to personal consumption of fuel, potentially supplementary outcomes are expected on psychological grounds rather than economic ones (Fawcett, 2010). First, fuel rationing through a carbon allowance is a radical policy and seen in this way may induce radical behaviour change. A second effect might come from making carbon visible at the end-user level, with a carbon account delivering frequent feedback on travel behaviour. A third effect could come from the social norm associated with a personal allowance fixed within the frame of a public policy: sticking to this personal target would be rewarded by the respect of others. However one should be cautious since fiscal or monetary incentives may “crowd out” intrinsic motivation to pro-environmental behaviour (Frey, 1997; Frey and Stutzer, 2008).

Some empirical studies indicate that personal carbon trading may induce additional emissions reduction when compared to carbon taxation (Bristow et al, 2010; Harwatt, 2008). However these studies remain largely exploratory due to the size of the samples.

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<sup>4</sup> It is argued that a tax combined with a direct fixed compensation would achieve the same objective. However such a scheme would be

Bristow et al (2010) have identified only five studies of behavioural response to personal carbon trading in the UK whether restricted to transport or not. More research is obviously needed on the interaction between economic mechanisms and psychological ones in the process of individual behaviour when facing cap-and-trade schemes. A study of stated choices of individuals (N~300) facing tradable permits or taxation in transport, undertaken by the author in France, will soon provide additional insights.

## 6. ACCEPTABILITY

If one considers the development of stringent objectives of emissions reduction in the future, a fuel rationing seems unavoidable: this rationing can basically take the form of either price rationing (tax) or quantities rationing (permits). From this point of view the acceptance of rationing is an identical precondition for the two instruments and needs at least an information campaign and a political willpower in order to introduce any measure of emission control. This is the first step which needs to be achieved. It is in this context of “accepted rationing” that the relative acceptability of tradable permits can be evaluated.

The “tax rebellion” that took place in several European countries during the high rise of oil price in September 2000 shows how

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subject to the same set-up and administrative costs as tradable permits.

sensitive the public opinion is to fuel taxation (Lyons and Chatterjee, 2002). Central government is a focus for opposition as it benefits from the tax, although it has little control over oil prices. Proposing a “CO<sub>2</sub> tax” in view of emissions reduction is likely to start again the debates on the use of the fiscal revenues from the excises, which currently in the majority of countries are not earmarked and play an essential part in the balance of public finances.

A first step to avoid raising too much revenue from voters who could successfully oppose the scheme would be to implement a tax with a threshold under which the fuel consumption would remain uncharged (Pezzey, 2003). A similar scheme was proposed by the French government in 2009 but cancelled in 2010 because of a massive rejection by the public opinion, despite the planned threshold (in fact a direct compensation) was taking into account the size of families and the consumption needs through the household residential location (urban or not).

Like for behavioural response to tradable permits scheme, studies about acceptability of these schemes are rather limited, and often combined with the studies about behavioural responses previously evoked. However a detailed study of how the design of schemes – whether personal carbon trading or carbon tax – influences their acceptability has been performed by Bristow et al (2008) in the UK with a stated preferences survey (N~300). Their key result is that personal carbon trading or

carbon tax may be both acceptable depending on the design of the schemes. In particular permits allocation is considered fairer when it includes children and takes into account the extra needs (e.g. remote home locations). Carbon tax with threshold may be nearly as acceptable, accompanied with revenue hypothecation. Other features of permits scheme include authorised use of excess permits, permit life, scope of the scheme, management of carbon accounts and market operation with government setting annually the price: the results are broadly consistent with the features of the scheme for private vehicles proposed above.

Another recent in-depth study in France (Lejoux and Raux, 2010), with a much smaller sample (N~38), is in line with some of the previous results regarding acceptability. According to the preferences expressed by the majority, the allowances should not be allocated only to motorists and should apply to both car and plane trips. Allowances should take into account the household size and residential location. However the people surveyed were equally divided regarding their preferences toward permits or carbon tax scheme.

## **7. CONCLUSION**

There are several directions of theoretical relevance for the use of emission trading in transportation. The controversy between pure taxation and pure tradable permits is no more topical: policymakers should consider hybrid instruments combining tradable permits, partly distributed for free and partly

auctioned, with a ceiling price as a “safety valve”.

There is no sound reason to dismiss downstream trading in principle on the basis of potentially high transaction costs. These costs depend on the actual design of the schemes to be implemented, including their needed features regarding behavioural effectiveness and acceptability. From this point of view the full range of instruments should be considered, including taxes, permits and their hybrids, tax thresholds or compensations, free permits and so on.

According to the theory, the policy efficiency would be maximised when the incentive to reduce emissions is put as close as possible to the decision-maker. Given the electronic technology available nowadays for monitoring end-user fuel purchase, schemes which are technically feasible have been presented. A parallel can be made with the case of electronic road pricing which has made road user charging feasible in urban areas.

There is a need to achieve the integration of transport emissions with existing schemes, especially the Emission Trading Scheme in the European Union. Opposite to harmonised taxation, emission trading in the transport sector can be quickly implemented, in coordination with other regions in the world. Due to its international nature, the implementation process could start with freight transportation.

The urgency now is to design fine-tuned practical schemes and to devise the optimal mix of economic and psychological incentives that may maximise the behavioural efficacy and the acceptability of a policy which could be actually implemented.

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